Review comments to manuscript: ERL-120863

A quantitative health impact assessment of urban greenspace and al-cause mortality across 1,041 global cities

by Greta K. Martin et al.

General comments:
This manuscript aims to quantify the impact of changes in green spaces on human health in global cities over a ten-year period. The authors use NDVI, aggregated into five-year intervals, to assess city-level changes, which serve as input for an exposure-response function linking NDVI to all-cause mortality. While no major global trends in NDVI or associated health impacts are observed, significant changes are noted in specific cities and years. The paper is well-written and addresses a topic relevant to ERL readers. However, the following issues need to be addressed, as outlined below:

Specific comments:

Health impact assessment

1. It would be helpful to explicitly discuss how increased greenspaces positively impact human health. Which specific diseases see a reduced risk, and through what mechanisms? For example, line 100 mentions that NDVI over a five-year period is used in the health assessment, implying that the exposure-response functions focus on short-term health impacts. Clarifying the pathways through which greenspaces influence health outcomes, along with their respective time scales, would strengthen the analysis. Additionally, how are these effects isolated from other contributing factors? For instance, increased urban greenspaces can lower near-surface temperatures, potentially mitigating extreme events like heat waves. Given that heat-related health impacts can be quantified separately, how do they compare to and differ from the health benefits attributed to NDVI? More importantly, how can these influences be disentangled in the analysis?
2. Since the analysis focuses on the peak season, the contribution of individual years may be highly relevant. Wouldn't it be more appropriate to analyze individual years rather than aggregated periods? Additionally, at what scales have the epidemiological functions been developed?
3. Starting from line 413, the health impact assessment appears to consider different population groups. However, there is no explanation or equation demonstrating how this dependence is incorporated into the exposure-response function. More details should be provided in the methods section.

Methods:

1. Line 149 and later: The paper attributes the large interannual variability in NDVI to meteorological factors. If this is the case, to what extent can NDVI reliably represent land-use changes and be used to infer health impacts? Would it be possible to quantify how much NDVI variability is driven by temperature fluctuations versus land-use changes due to urbanization?

Existing literature or simple correlation analyses could help address this question. Additionally, could a land-use dataset that includes both land-use type and urban fraction help identify whether surface property changes have occurred? More evidence is needed to explain and attribute the observed interannual variability in NDVI.

2. Over the 10-year period analyzed, many cities have undergone changes in size. How is this accounted for? If city boundary changes are measured, how are they incorporated into the health impact assessment? It would be helpful to interpret the observed changes for specific cities in relation to their growth, urbanization levels, and other relevant factors. Additionally, is there variability within cities at the sub-city level? If so, how is it considered when computing an aggregate metric for individual cities?

Technical comments:

- Line 33: why is NDVI higher and more stable in European and North American cities? The sentence continues by talking about epidemiological studies performed in those areas, however the two aspects are unrelated. Please clarify.
- Line 62: is this true everywhere? I believe cities in the developing world have very different emission regimes than the ones in developed countries. Please revise.
- Line 145: what is "i" in Equation 2? Does it refer to the pixels? How is the HR defined? An explicit expression for that should be provided. Also, it is not clear which spatial resolution NDVI and population data have and how they are homogenized in the present analysis.
- Figure 3: what do the colored dots represent and the box plots? More details are needed in the caption.
- Line 309: is the IQR: 0.13 – 8.5?
- Line 319: this section is confusing. What does a median change in mortality of 0.01 fewer means? There is mention of a change in NDVI in that sentence, but how much change? Also, it would be useful to contextualize changes in NDVI due to various factors. E.g. the mentioned 0.19 change in NDVI how can that be interpreted? Is it typical of a greener season due to more favorable weather conditions or is it the change expected when land use changes from urban/concrete to forest? Some references are needed through the text.
- Line 326: the ranges expressed as "fewer to more" are quite confusing, so it would be clearer if there was a sentence explaining how this wording will be used and interpreted
- Figure 5: remove "Associated".
- Line 385: the impact on individual cities would be very relevant to be discussed and possibly compared with cities in the same region that do not experience such changes.
- Line 419: most of the paper mentioned that NDVI had remained stable over the period analyzed. However, the authors mention that NDVI has decreased over time. This seems to contradict what discussed before.
- Conclusions are too short. I suggest merging with discussion.